REMARKS

Applicant respectfully requests reconsideration of this application as amended. By this amendment, the specification has been amended to correct minor informalities and the claims amended to more clearly distinguish the present invention from the prior art cited by the Examiner.

Claims 1 - 12 and 14 - 23 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Bohlen et al. for the reasons of record in the office action dated March 29, 1993 and for the additional reasons set forth in the office action dated August 6, 1993.

In the March 29, 1993 office action the Examiner states that the present invention is anticipated because "Bohlen et al. discloses a method of printing or transferring a pattern into a radiation-sensitive layer or substrate, . . ." which includes two partial patterns being latently transferred respectively " . . . and thus, the two patterns are projected successively". Examiner further states that "Bohlen et al. discloses each and every aspect of claim 1 as claimed by the applicant . . ."

Bohlen's method is directed towards improving a certain type of prior art method utilized to transfer patterns. Specifically, Bohlen's preamble in Claim 1 states, "Method of transferring a pattern to a radiation sensitive layer on substrates, where two partial masking patterns which when superimposed upon each other in a predetermined alignment, yield the complete pattern, . . ." Further, Bohlen's specification references an article which describes the method to which his improvement is applicable to, i.e. "Method of Art Work Generation" (column 2, line 8). In addition, Bohlen also states in column 4 lines 22 - 27, that, "It is the object of the invention to provide a method of transferring a pattern . . . where two partial patterns which represent the pattern if superimposed upon each other in a corresponding alignment, and which partly overlap . . ." Thus, Bohlen's claims and specification describe a specific type of printing method to which Bohlen's method is to be utilized with.

Bohlen teaches a method that reduces the amount of overlap or the gap between the partial patterns when recombined to form the completed pattern, (see column 2, lines 40 - 59). Thus, the problem that Bohlen solves is specific to a certain type of pattern transference method, i.e. breaking a full, complete

pattern into a number of smaller partial patterns, where the sum of the full pattern is equal to the superimposed partial patterns.

Bohlen's method requires a partitioning step and also steps including both positive and negative windage exposure of full and partitioned elements, as recited in Bohlen's claims. For example, claim 1 of Bohlen discloses a method comprising the steps of:

(1) "producing a complete pattern of the pattern to be transferred,"

(2) "producing a reduced size image of the complete pattern by exposure of the complete pattern to negative windage to thereby reduce the size of the elements of the pattern by a predetermined amount,"

(3) "partitioning the resultant complete pattern reduced in size by negative windage into two negative windage partial patterns,"

(4) "producing two expanding partial masking patterns by exposing the partial patterns to positive windage to thereby increase the size of the elements in the partial patterns by a predetermined amount to compensate for the amount reduced by negative windage;"

5) "said expanded partial patterns collectively used for exposing a radiation sensitive layer to define said desired pattern."

Thus, as stated above in steps (2), (3) and (4) the complete pattern is first reduced by a negative windage step, then partitioned into two partial masking patterns by a negative windage step. Next, the partial patterns are expanded by a positive windage step, and finally the expanded partial patterns are used to define the desired pattern. Thus, Bohlen's method mandates both positive and negative exposure steps to obtain the desired results. The purpose of Bohlen's partitioning and positive and negative windage steps is to eliminate gaps and/or significant overlap between the partial patterns (an acceptable overlap is achieved). By way of example, Figure 6D shows an acceptable overlap area 7 of the partial elements 4 and 6 when recombined to form the complete element.

In contrast, the present invention is not directed towards the specific printing method of Bohlen; rather, applicant's method provides a way of extending the resolution limits of an existing lithographic tool without changing the specific lithographic settings and printing conditions (i.e. exposure wavelength and numerical aperture). This is achieved by printing the edges of

patterns in such a way that the edge gradients do not interact. This means that edges can be printed closer together, thus realizing in smaller features.

The Examiner considers that Bohlen teaches essentially the same invention since Bohlen discloses partitioning a complete pattern into partial patterns. Apparently, the Examiner concludes that Bohlen's "partial patterns" are the same as Applicant's claimed "first and second mask image segments". Applicant respectfully submits that Bohlen's "partial elements" are defined differently, and thus do not correspond to, the "first and second mask images" of the present invention, thus making Bohlen's and the present invention's method different.

Specifically, the "first and second mask image segment" of the present invention each correspond to one edge of the element to be transferred, whereas, Bohlen's "partial patterns" correspond to two-dimensional elements which normally have at least two parallel edges. By way of example, referring to Bohlen's Figures 6B and 6C, each of partial elements 4, 6, 14, and 15 comprise two sets of parallel edges. Partial element 4 has two elongated parallel edges and two short parallel edges. These parallel edges are printed simultaneously with respect to one another. For instance, when Bohlen prints partial element 4, both of the long edges and the short edges are printed simultaneously. Thus, although Bohlen's "partial patterns" are printed successively, (i.e. partial patterns 14 and 15 are printed first and partial elements 4 and 6 are subsequently printed), the parallel edges are always printed simultaneously.

Further, Applicant respectfully contends that Bohlen defines and uses the term "partial elements" in his specification and claims in a manner consistent with the type of partial elements shown in Figures 1 - 6. Nowhere in Bohlen's patent does he mention or suggest that the term "partial pattern" is broad enough to encompass isolated edges of a feature. Thus, Applicant respectfully contends that Bohlen would not have provided any motivation to an ordinary practitioner to partition his "partial elements" into isolated edges since this would not yield Bohlen's improvement, i.e. an acceptable overlap area. (see Figure 6D).

Additionally, it should be noted that the parallel edges of each of the "partial patterns" in Bohlen's disclosure will still suffer the proximity problems as described in the present invention's disclosure (if the parallel edges are spaced too closely together). Bohlen is completely silent regarding the problem of proximity effects exhibited by parallel edges. He certainly does not suggest exposing separate parallel edges of the partial patterns to correct for the proximity effect problem.

On the other hand, the present invention is solely concerned with the problem of printing edges in close proximity. Instead of partitioning a complete element into many partial elements, with each element having an associated set of parallel edges. the present invention utilizes mask image segments that correspond to the respective edges of a feature. These edges are exposed successively so as to reproduce the complete feature or element.

Clearly then, whereas the present invention employs successive exposures of image segments representing feature edges to reduce proximity effects, Bohlen partitions complete elements into partial elements having parallel edges; he then subjects the partial elements to negative and positive windage exposures so as to avoid large gaps and/or excessive overlapping between partial elements. In this sense, Bohlen's method actually teaches away from the present invention.

Claims 1 - 12 and 14 - 23 also stand rejected under 35 U.S.C. § 103 as being unpatentable over Bohlen in view of Gilson for the reasons of record in the office action dated March 29, 1993.

Gilson teaches a method for reducing diffraction problems occurring during imaging of a feature on a substrate by means of a hologram mask that contains a Fourier transform of the image (column 2, lines 20 - 23). According to Gilson a much higher resolution is achieved as compared to conventional masking methods. In contrast, the present invention eliminates diffraction interaction of closely-spaced edges by utilizing multiple masks -- each representing a different feature edge -- and then exposing each of the edge masks separately. Thus, the present invention images multiple edge masks separately while Gilson projects a single mask containing a Fourier Transform of the whole image.

For the foregoing reasons, Applicant respectfully submits that the present invention would not have been obvious in view of the combination of Bohlen and Gilson. Simply put, there is nothing in Gilson's Fourier transform method that would have motivated an ordinary practitioner to partition Bohlen's "elements" into separately distinct edge segments in order to reduce the problem of proximity effects.

Accordingly, Applicant respectfully submits that all rejections have been overcome by this amendment. The application is now in condition for allowance and such action is earnestly solicited. Cancellation and withdrawal of all rejections is respectfully requested.

Please charge any shortages and credit any overages to Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

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Bradley J. Bereznak
Reg. No. 33,474

12400 Wilshire Boulevard
Seventh Floor
Los Angeles, CA 90025-1026

(408) 720-8598

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on September 9, 1993

Peach E. Dworkin

(P.E. Dworkin 9/9/93